

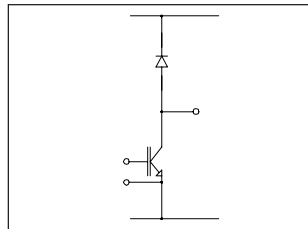
## 50MT060ULS

"LOW SIDE CHOPPER" IGBT MTP

Ultrafast Speed IGBT

### Features

- Gen. 4 Ultrafast Speed IGBT Technology
- HEXFRED™ Diode with UltraSoft Reverse Recovery
- Very Low Conduction and Switching Losses
- Optional SMT Thermistor (NTC)
- Aluminum Nitride DBC
- Very Low Stray Inductance Design for High Speed Operation
- UL approved ( file E78996 )



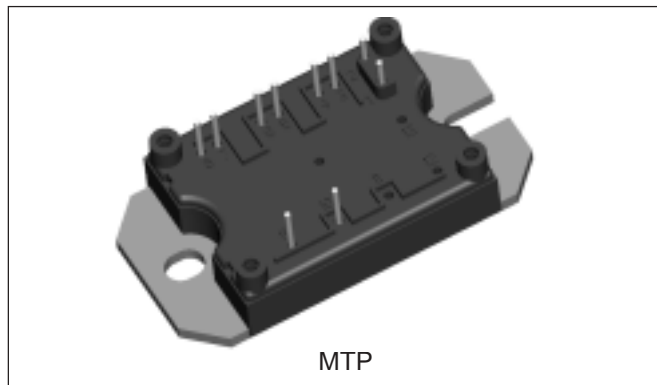
$$V_{CES} = 600V$$

$$I_C = 100A,$$

$$T_C = 25^{\circ}C$$

### Benefits

- Optimized for Welding, UPS and SMPS Applications
- Operating Frequencies > 20 kHz Hard Switching, >200 kHz Resonant Mode
- Low EMI, requires Less Snubbing
- Direct Mounting to Heatsink
- PCB Solderable Terminals
- Very Low Junction-to-Case Thermal Resistance



MTP

### Absolute Maximum Ratings

Parameters				Max	Units
$V_{CES}$	Collector-to-Emitter Voltage			600	V
$I_C$	Continuos Collector Current	@ $T_C = 25^{\circ}C$		100	A
		@ $T_C = 122^{\circ}C$		50	
$I_{CM}$	Pulsed Collector Current			200	
$I_{LM}$	Peak Switching Current			200	V
$I_F$	Diode Continuous Forward Current			48	
$I_{FM}$	Peak Diode Forward Current			200	
$V_{GE}$	Gate-to-Emitter Voltage			$\pm 20$	W
$V_{ISOL}$	RMS Isolation Voltage, Any Terminal to Case, t = 1 min			2500	
$P_D$	Maximum Power	IGBT	@ $T_C = 25^{\circ}C$	445	
			@ $T_C = 100^{\circ}C$	175	
	Dissipation	Diode	@ $T_C = 25^{\circ}C$	205	
			@ $T_C = 100^{\circ}C$	83	

### Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)

Parameters	Min	Typ	Max	Units	Test Conditions
V <sub>(BR)CES</sub> Collector-to-Emitter Breakdown Voltage	600			V	V <sub>GE</sub> = 0V, I <sub>C</sub> = 250μA
V <sub>CE(on)</sub> Collector-to-Emitter Voltage		1.69	2.31		V <sub>GE</sub> = 15V, I <sub>C</sub> = 50A
		1.96	2.55		V <sub>GE</sub> = 15V, I <sub>C</sub> = 100A
		1.88	2.24		V <sub>GE</sub> = 15V, I <sub>C</sub> = 100A, T <sub>J</sub> = 150°C
V <sub>GE(th)</sub> Gate Threshold Voltage	3		6		I <sub>C</sub> = 0.5mA
B <sub>VR</sub> Diode Reverse Breakdown Voltage	600				I <sub>R</sub> = 200μA
ΔV <sub>GE(th)</sub> /ΔT <sub>J</sub> Temperature Coeff. of Threshold Voltage		- 13		mV/°C	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 500μA
g <sub>fe</sub> Forward Transconductance	22	29		S	V <sub>CE</sub> = 50V, I <sub>C</sub> = 100A
I <sub>CES</sub> Collector-to-Emitter Leaking Current			0.25	mA	V <sub>GE</sub> = 0V, V <sub>CE</sub> = 600V
			6		V <sub>GE</sub> = 0V, V <sub>CE</sub> = 600V, T <sub>J</sub> = 150°C
V <sub>FM</sub> Diode Forward Voltage Drop		1.64	1.82	V	I <sub>F</sub> = 100A, V <sub>GE</sub> = 0V
		1.56	1.74		I <sub>F</sub> = 100A, V <sub>GE</sub> = 0V, T <sub>J</sub> = 150°C
I <sub>GES</sub> Gate-to-Emitter Leakage Current			± 250	nA	V <sub>GE</sub> = ± 20V

### Switching Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)

Parameters	Min	Typ	Max	Units	Test Conditions
Q <sub>g</sub> Total Gate Charge (turn-on)		370	555	nC	I <sub>C</sub> = 100A
Q <sub>ge</sub> Gate-Emitter Charge (turn-on)		64	96		V <sub>CC</sub> = 480V
Q <sub>gc</sub> Gate-Collector Charge (turn-on)		163	245		V <sub>GE</sub> = 15V
E <sub>on</sub> Turn-On Switching Loss		0.7	1.2	mJ	I <sub>C</sub> = 50A, V <sub>CC</sub> = 480V, V <sub>GE</sub> = 15V,
E <sub>off</sub> Turn-Off Switching Loss		1.7	2.6		R <sub>g</sub> = 5Ω
E <sub>ts</sub> Total Switching Loss		2.4	3.8		Energy losses include tail and diode reverse recovery
E <sub>on</sub> Turn-On Switching Loss		1.1	1.7	mJ	I <sub>C</sub> = 50A, V <sub>CC</sub> = 480V, V <sub>GE</sub> = 15V
E <sub>off</sub> Turn-Off Switching Loss		2.5	3.8		R <sub>g</sub> = 5Ω, T <sub>J</sub> = 125°C
E <sub>ts</sub> Total Switching Loss		3.6	5.5		Energy losses include tail and diode reverse recovery
C <sub>ies</sub> Input Capacitance		9800	14700		V <sub>GE</sub> = 0V
C <sub>oes</sub> Output Capacitance		602	903	pF	V <sub>CC</sub> = 30V
C <sub>res</sub> Reverse Transfer Capacitance		121	182		f = 1.0 MHz
C <sub>t</sub> Diode Junction Capacitance		118	177		V <sub>r</sub> = 600V, f = 1.0 MHz
trr Diode Reverse Recovery Time		99	150	ns	V <sub>CC</sub> = 480V, I <sub>C</sub> = 50A
I <sub>rr</sub> Diode Peak Reverse Current		6.5	9.8	A	di/dt = 200A/μs
Q <sub>rr</sub> Diode Recovery Charge		320	735	nC	R <sub>g</sub> = 5Ω
di <sub>(rec)</sub> M/dt Diode PeakRate of Fall of Recovery During t <sub>b</sub>		236		A/μs	

### Thermistor Specifications (50MT060ULST only)

Parameters	Min	Typ	Max	Units	Test Conditions
$R_0^{(1)}$ Resistance		30		k $\Omega$	$T_0 = 25^\circ\text{C}$
$\beta^{(1)(2)}$ Sensitivity index of the thermistor material		4000		K	$T_0 = 25^\circ\text{C}$ $T_1 = 85^\circ\text{C}$

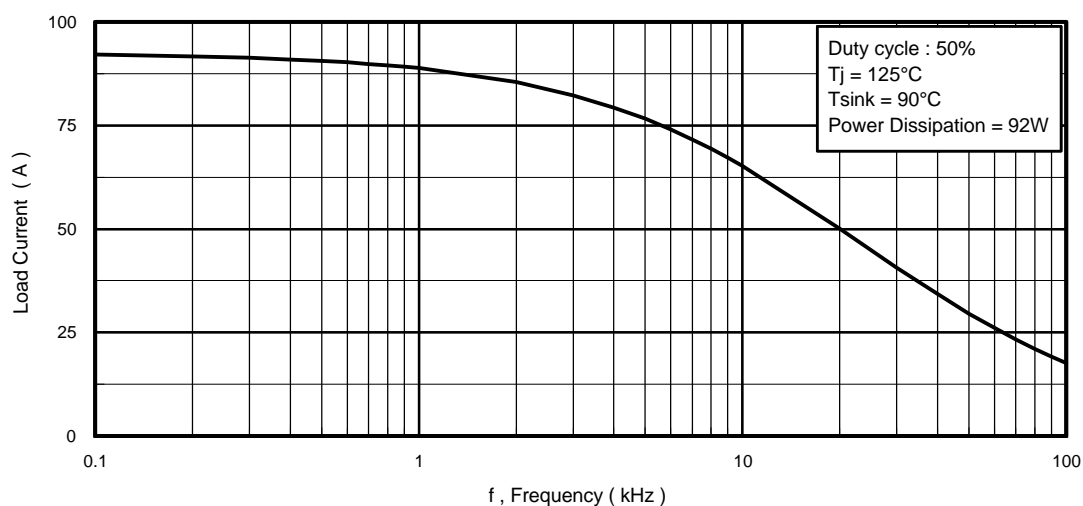
(1)  $T_0, T_1$  are thermistor's temperatures

$$(2) \frac{R_0}{R_1} = \exp \left[ \beta \left( \frac{1}{T_0} - \frac{1}{T_1} \right) \right], \text{ Temperatures in kelvin}$$

### Thermal- Mechanical Specifications

Parameters	Min	Typ	Max	Units
$T_J$ Operating Junction Temperature Range	- 40		150	$^\circ\text{C}$
$T_{STG}$ Storage Temperature Range	- 40		125	
$R_{thJC}$ Junction-to-Case	IGBT	0.18	0.28	$^\circ\text{C}/\text{W}$
	Diode	0.4	0.6	
$R_{thCS}$ Case-to-Sink (Heatsink Compound Thermal Conductivity = 1 W/mK)	Module	0.06		
T Mounting torque to heatsink (3)		$3 \pm 10\%$		Nm
Wt Weight		66		g

(3) A mounting compound is recommended and the torque should be checked after 3 hours to allow for the spread of the compound. Lubricated threads



**Fig. 1** - Typical Load Current vs. Frequency  
(Load Current =  $I_{RMS}$  of fundamental)

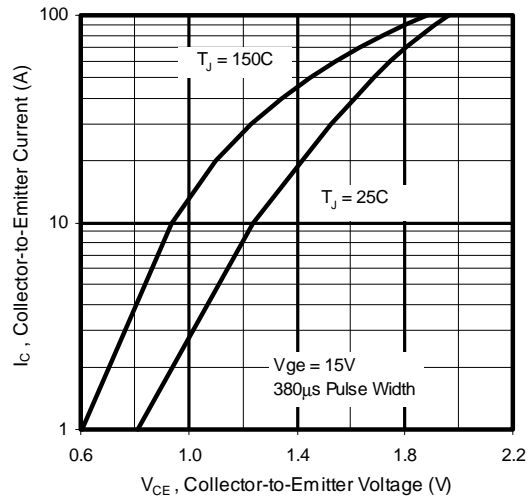


Fig. 2 - Typical Output Characteristics

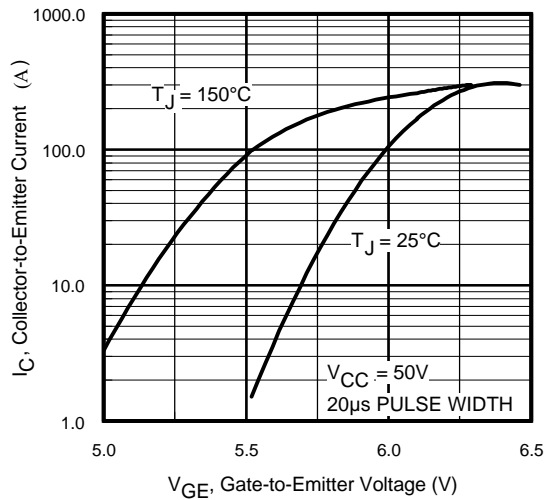


Fig. 3 - Typical Transfer Characteristics

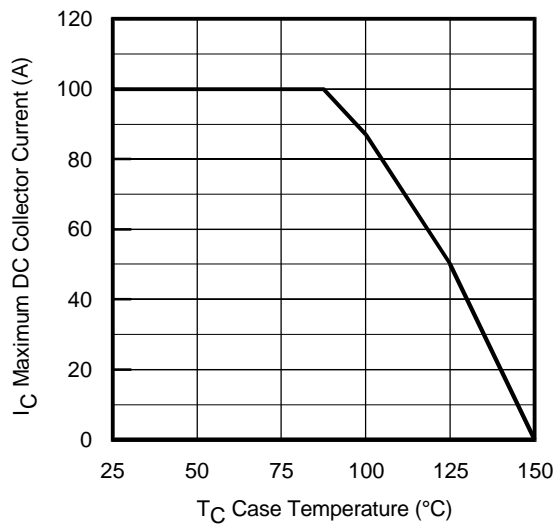


Fig. 4 - Maximum Collector Current vs. Case Temperature

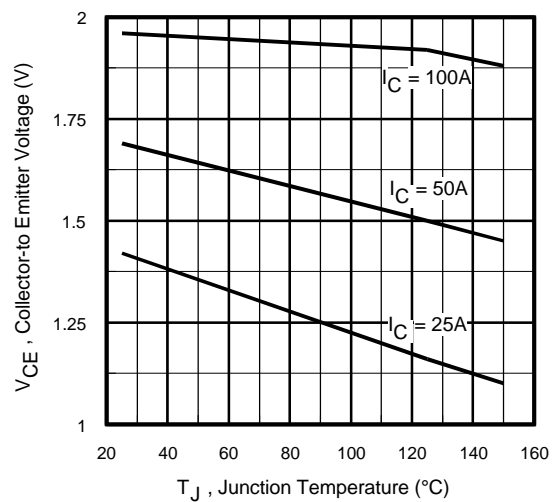


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

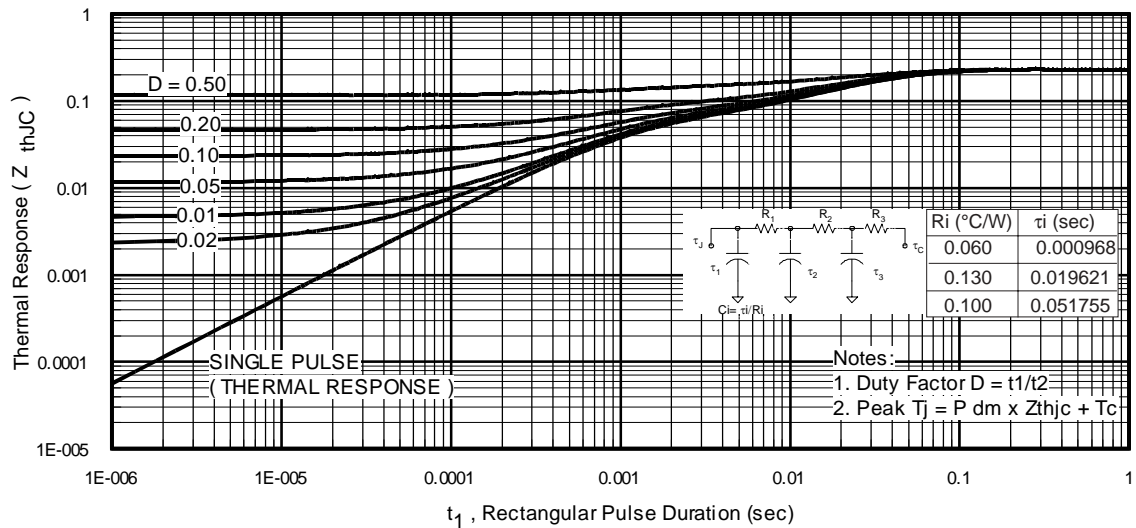


Fig. 6a Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)

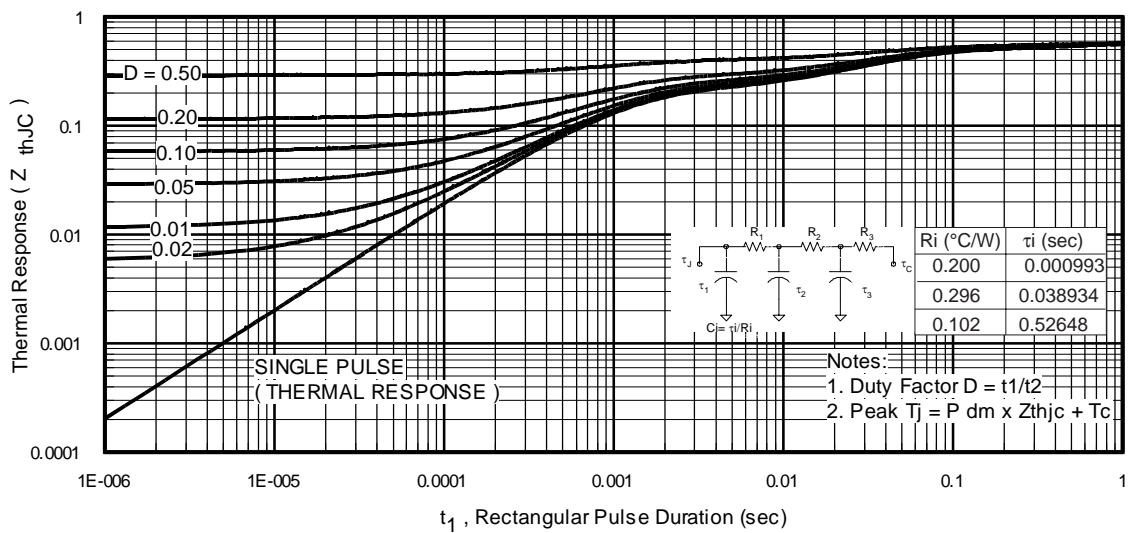
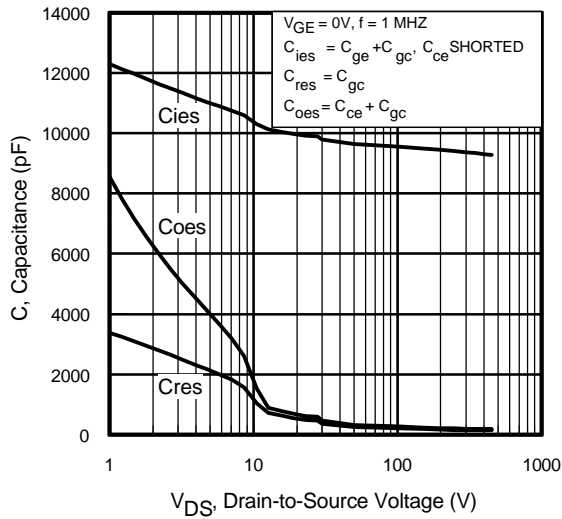
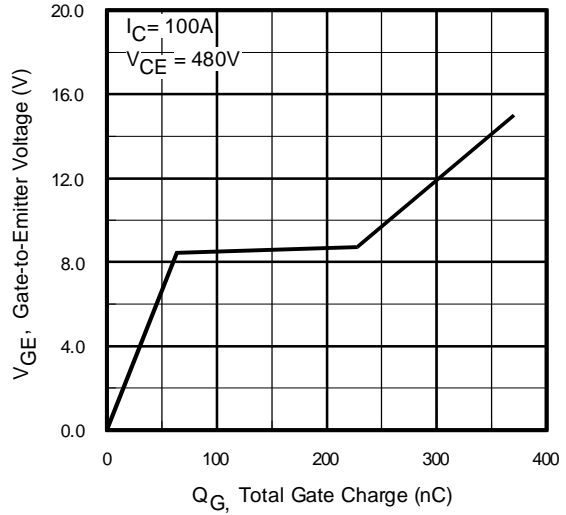


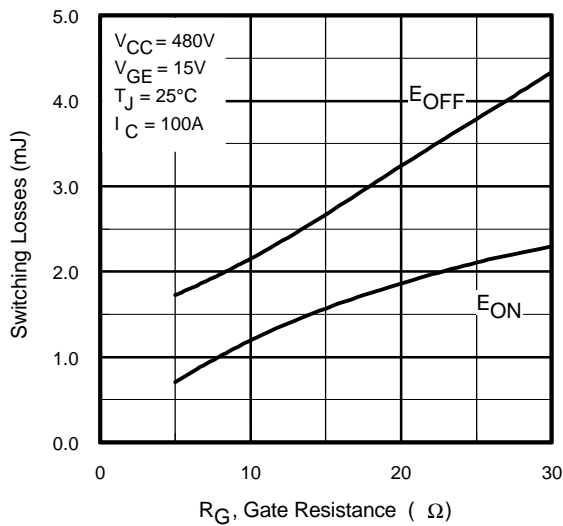
Fig. 6b Maximum Transient Thermal Impedance, Junction-to-Case (DIODE)



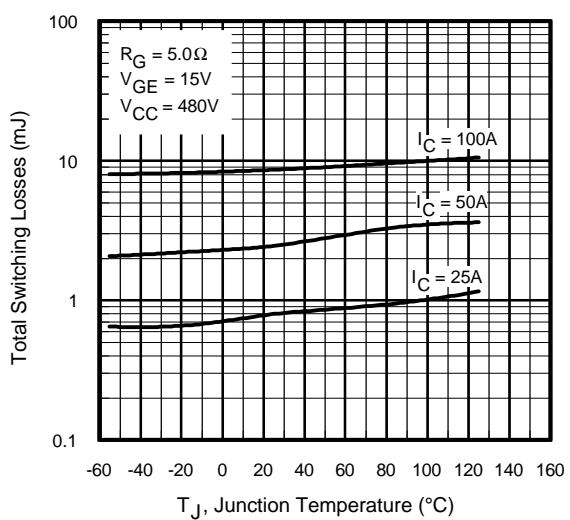
**Fig. 7** - Typical Capacitance vs. Collector-to-Emitter Voltage



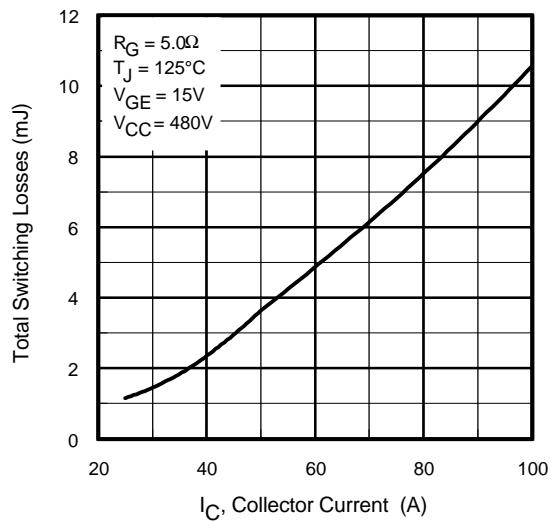
**Fig. 8** - Typical Gate Charge vs. Gate-to-Emitter Voltage



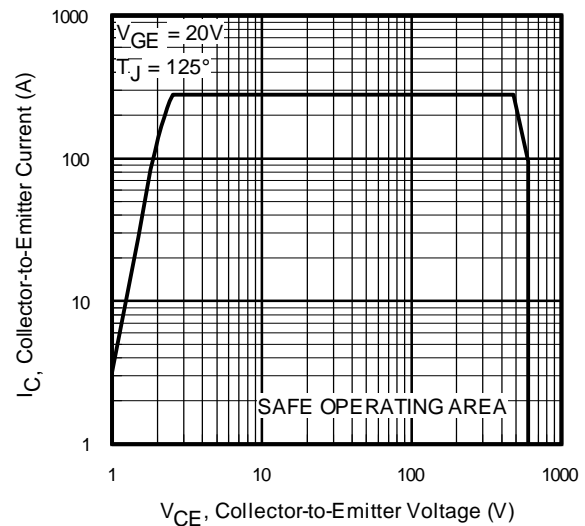
**Fig. 9** - Typical Switching Losses vs. Gate Resistance



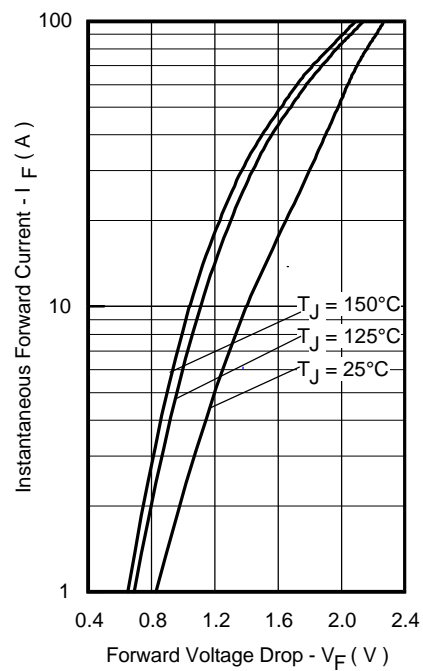
**Fig. 10** - Typical Switching Losses vs. Junction Temperature



**Fig. 11** - Typical Switching Losses vs.  
Collector-to-Emitter Current



**Fig. 12** - Turn-Off SOA



**Fig. 13** - Maximum Forward Voltage Drop vs.  
Instantaneous Forward Current

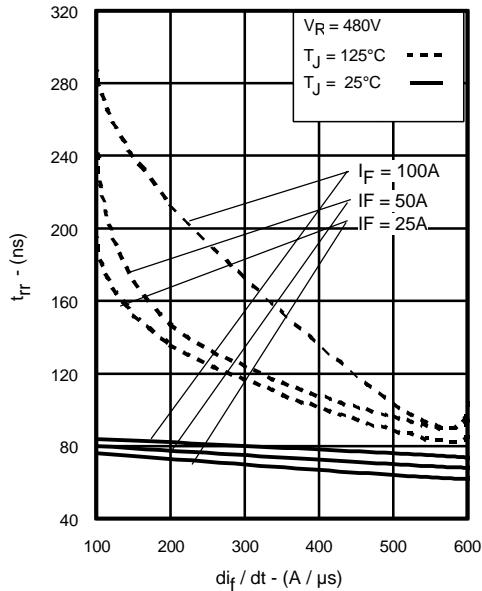


Fig. 14 - Typical Reverse Recovery vs.  $di_f/dt$

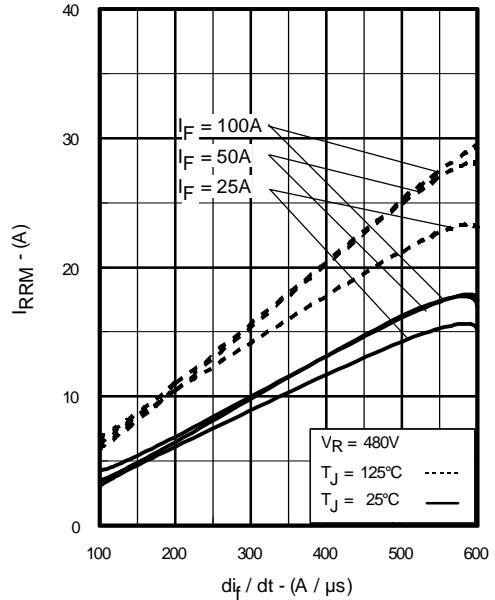


Fig. 15 - Typical Recovery Current vs.  $di_f/dt$

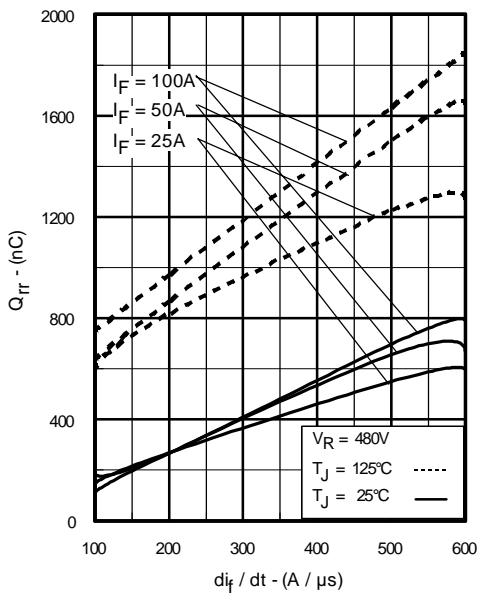


Fig. 16 - Typical Stored Charge vs.  $di_f/dt$

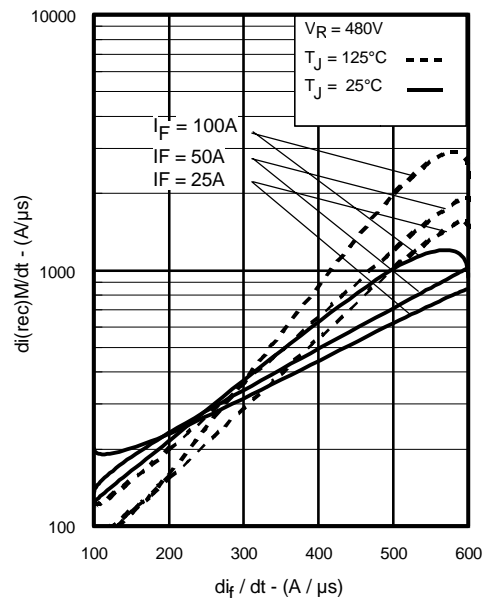
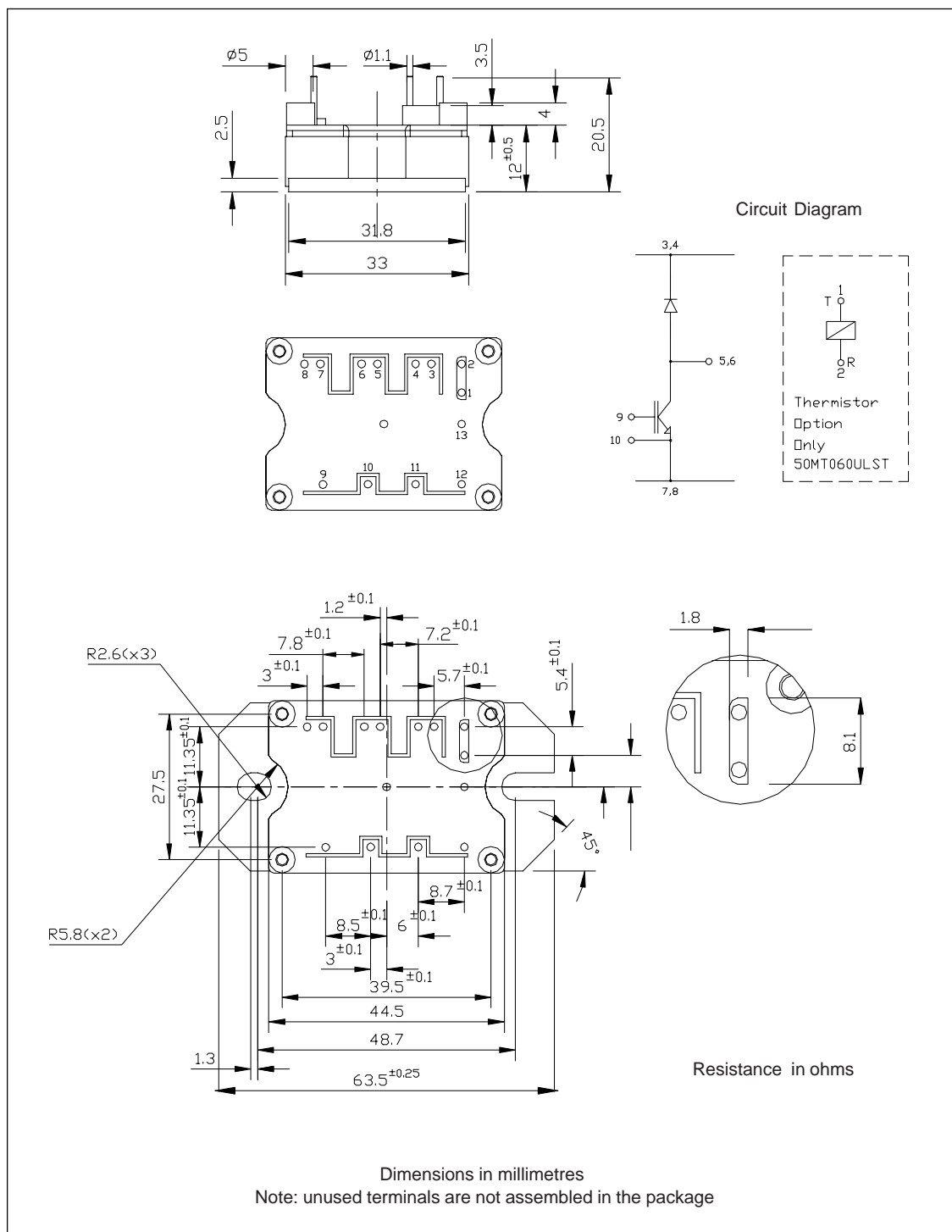


Fig. 17 - Typical  $di_{(rec)M}/dt$  vs.  $di_f/dt$



## Outline Table



## Ordering Information Table

Device Code					
	50	MT	060	U	LS -
	①	②	③	④	⑤ ⑥
1	-	Current rating	(50 = 50A)		
2	-	Essential Part Number			
3	-	Voltage code	(060 = 600V)		
4	-	Speed/ Type	(U = Ultra Fast IGBT)		
5	-	Circuit Configuration	(LS = Low Side Chopper)		
6	-	Special Option			<div> Empty = no special option  T = Thermistor </div>

Data and specifications subject to change without notice.  
This product has been designed and qualified for Industrial Level.  
Qualification Standards can be found on IR's Web site.

International  
**IR** Rectifier

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