

International IOR Rectifier

I27123 rev. C 02/03

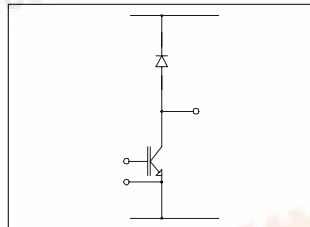
50MT060ULS

"LOW SIDE CHOPPER" IGBT MTP

Ultrafast Speed IGBT

Features

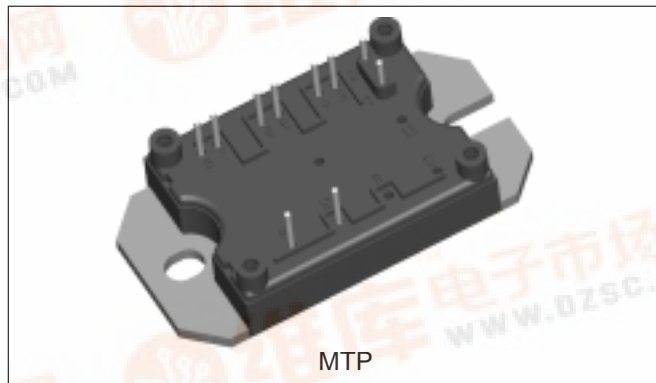
- Gen. 4 Ultrafast Speed IGBT Technology
- HEXFRED™ Diode with UltraSoft Reverse Recovery
- Very Low Conduction and Switching Losses
- Optional SMT Thermistor (NTC)
- Aluminum Nitride DBC
- Very Low Stray Inductance Design for High Speed Operation
- UL approved (file E78996)



$V_{CES} = 600V$
 $I_C = 100A,$
 $T_C = 25^\circ C$

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



Absolute Maximum Ratings

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

Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

Parameters		Min	Typ	Max	Units	Test Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	600			V	$V_{GE} = 0V, I_C = 250\mu A$
$V_{CE(on)}$	Collector-to-Emitter Voltage		1.69	2.31		$V_{GE} = 15V, I_C = 50A$
			1.96	2.55		$V_{GE} = 15V, I_C = 100A$
			1.88	2.24		$V_{GE} = 15V, I_C = 100A, T_J = 150^\circ\text{C}$
$V_{GE(th)}$	Gate Threshold Voltage	3		6	$I_C = 0.5mA$	
B_{VR}	Diode Reverse Breakdown Voltage	600				$I_R = 200\mu A$
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage		- 13		mV/°C	$V_{CE} = V_{GE}, I_C = 500\mu A$
g_{fe}	Forward Transconductance	22	29		S	$V_{CE} = 50V, I_C = 100A$
I_{CES}	Collector-to-Emitter Leaking Current			0.25	mA	$V_{GE} = 0V, V_{CE} = 600V$
				6		$V_{GE} = 0V, V_{CE} = 600V, T_J = 150^\circ\text{C}$
V_{FM}	Diode Forward Voltage Drop		1.64	1.82	V	$I_F = 100A, V_{GE} = 0V$
			1.56	1.74		$I_F = 100A, V_{GE} = 0V, T_J = 150^\circ\text{C}$
I_{GES}	Gate-to-Emitter Leakage Current			± 250	nA	$V_{GE} = \pm 20V$

Switching Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

Parameters		Min	Typ	Max	Units	Test Conditions
Q_g	Total Gate Charge (turn-on)		370	555	nC	$I_C = 100A$ $V_{CC} = 480V$ $V_{GE} = 15V$
Q_{ge}	Gate-Emitter Charge (turn-on)		64	96		
Q_{gc}	Gate-Collector Charge (turn-on)		163	245		
E_{on}	Turn-On Switching Loss		0.7	1.2	mJ	$I_C = 50A, V_{CC} = 480V, V_{GE} = 15V,$ $R_g = 5\Omega$ Energy losses include tail and diode reverse recovery
E_{off}	Turn-Off Switching Loss		1.7	2.6		
E_{ts}	Total Switching Loss		2.4	3.8		
E_{on}	Turn-On Switching Loss		1.1	1.7	mJ	$I_C = 50A, V_{CC} = 480V, V_{GE} = 15V$ $R_g = 5\Omega, T_J = 125^\circ\text{C}$ Energy losses include tail and diode reverse recovery
E_{off}	Turn-Off Switching Loss		2.5	3.8		
E_{ts}	Total Switching Loss		3.6	5.5		
C_{ies}	Input Capacitance		9800	14700	pF	$V_{GE} = 0V$ $V_{CC} = 30V$ $f = 1.0\text{ MHz}$ $V_r = 600V, f = 1.0\text{ MHz}$
C_{oes}	Output Capacitance		602	903		
C_{res}	Reverse Transfer Capacitance		121	182		
C_t	Diode Junction Capacitance		118	177		
t_{rr}	Diode Reverse Recovery Time		99	150	ns	$V_{CC} = 480V, I_C = 50A$
I_{rr}	Diode Peak Reverse Current		6.5	9.8	A	$di/dt = 200A/\mu s$
Q_{rr}	Diode Recovery Charge		320	735	nC	$R_g = 5\Omega$
$di_{(rec)}/dt$	Diode Peak Rate of Fall of Recovery During t_b		236		A/ μs	

Thermistor Specifications (50MT060ULST only)

Parameters	Min	Typ	Max	Units	Test Conditions
R ₀ ⁽¹⁾ Resistance		30		kΩ	T ₀ = 25°C
β ⁽¹⁾⁽²⁾ Sensitivity index of the thermistor material		4000		K	T ₀ = 25°C T ₁ = 85°C

(1) T₀, T₁ 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	°C
T _{STG} Storage Temperature Range	- 40		125	
R _{thJC} Junction-to-Case	IGBT		0.18	°C/ W
	Diode		0.4	
R _{thCS} Case-to-Sink (Heatsink Compound Thermal Conductivity = 1 W/mK)	Module		0.06	
T Mounting torque to heatsink (3)		3 ± 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

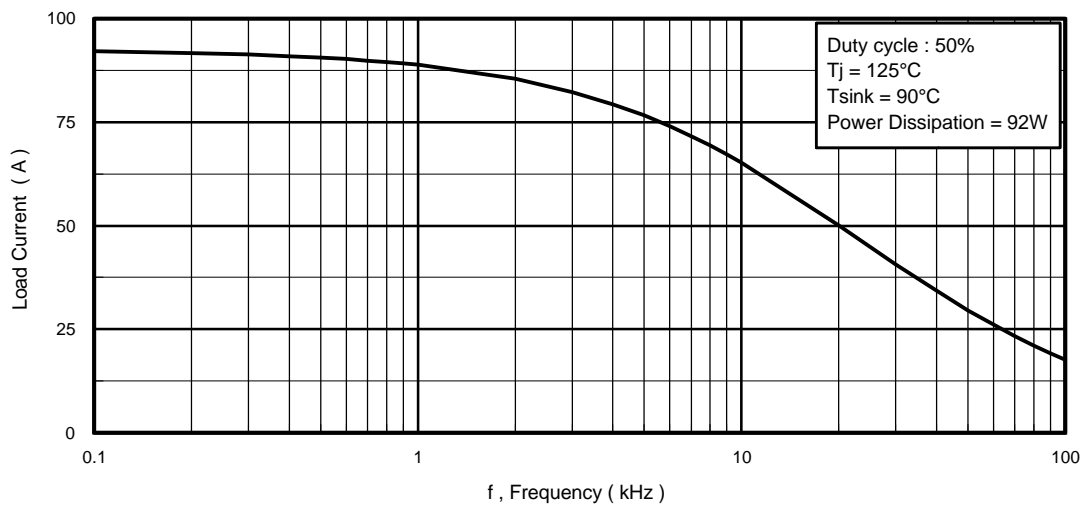


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

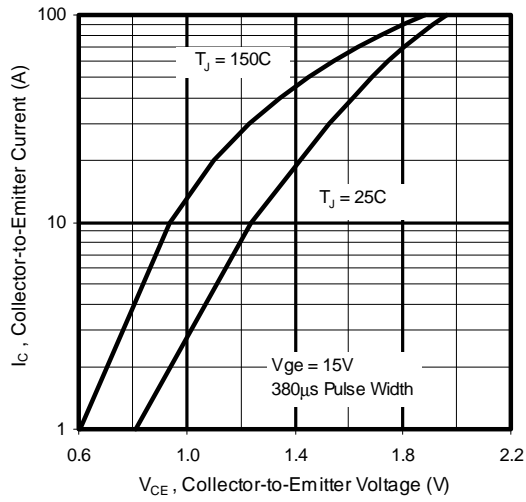


Fig. 2 - Typical Output Characteristics

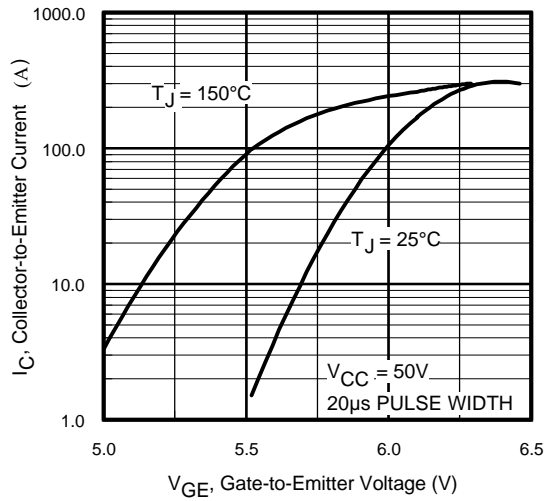


Fig. 3 - Typical Transfer Characteristics

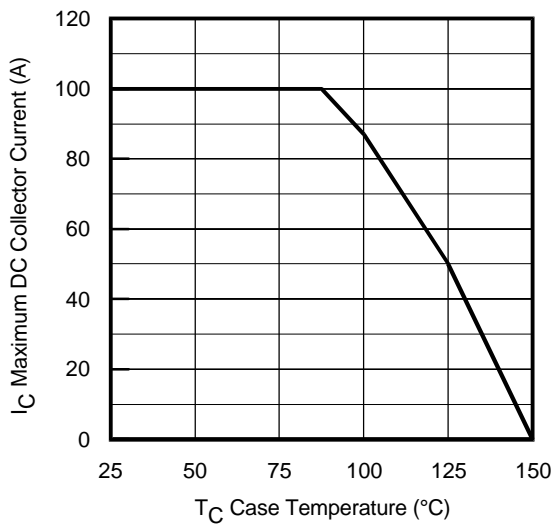


Fig. 4 - Maximum Collector Current vs. Case Temperature

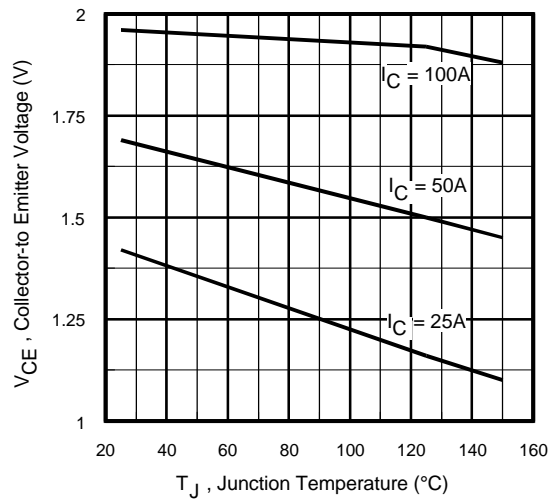


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

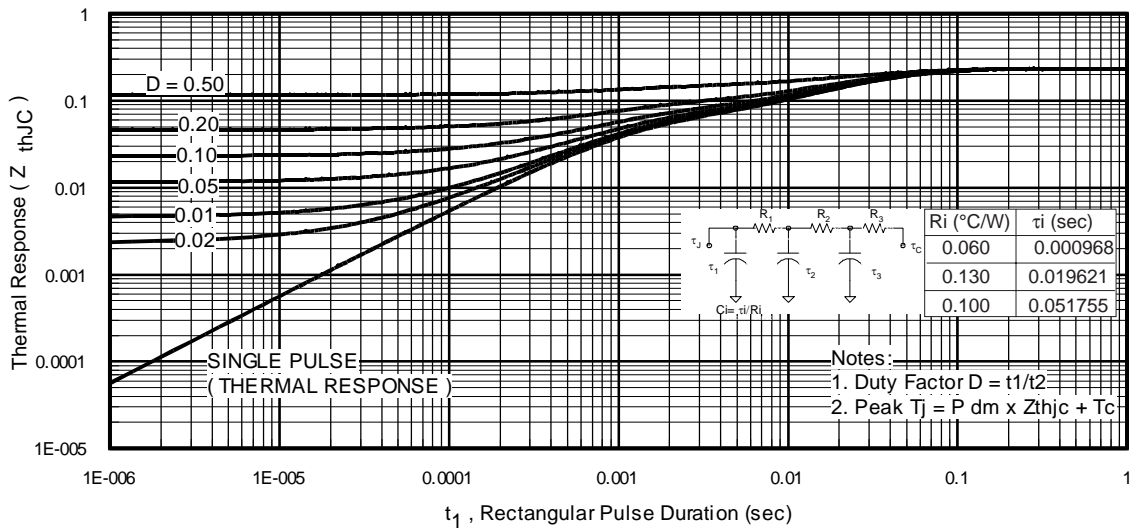


Fig. 6a Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)

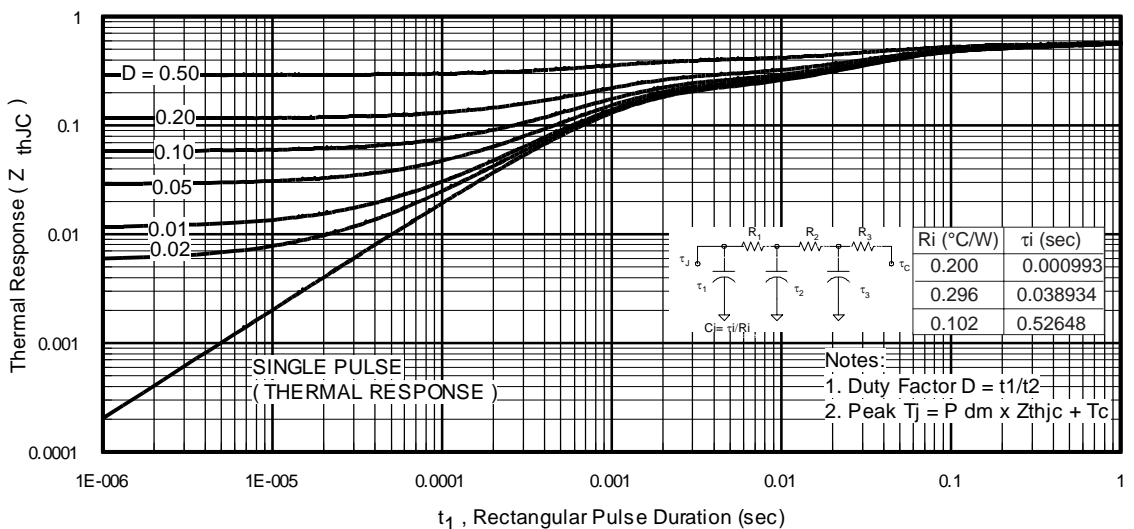


Fig. 6b Maximum Transient Thermal Impedance, Junction-to-Case (DIODE)

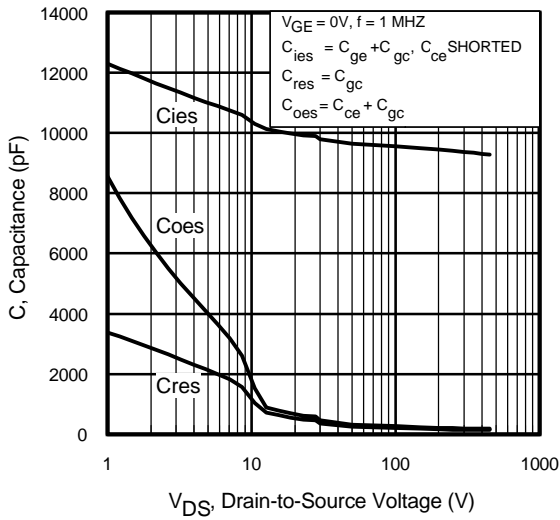


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

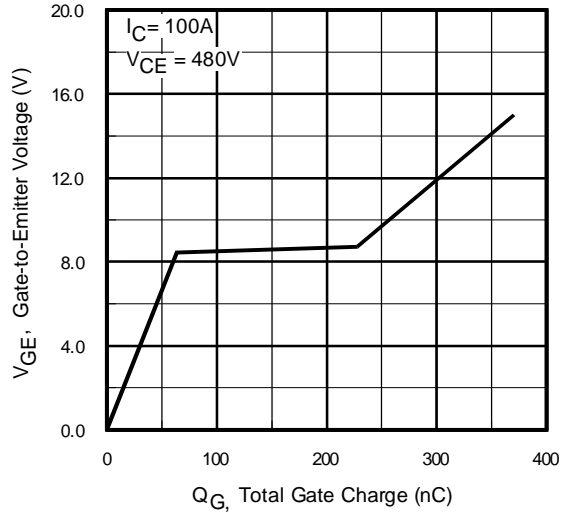


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

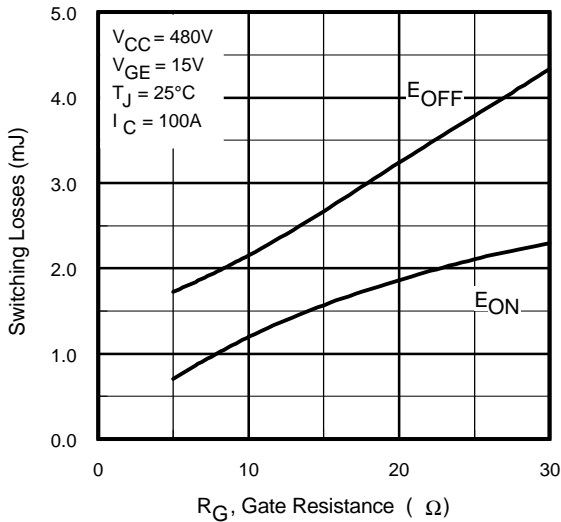


Fig. 9 - Typical Switching Losses vs. Gate Resistance

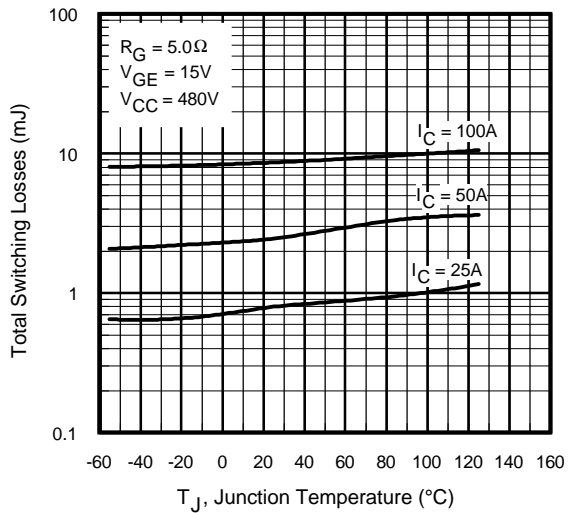


Fig. 10 - Typical Switching Losses vs. Junction Temperature

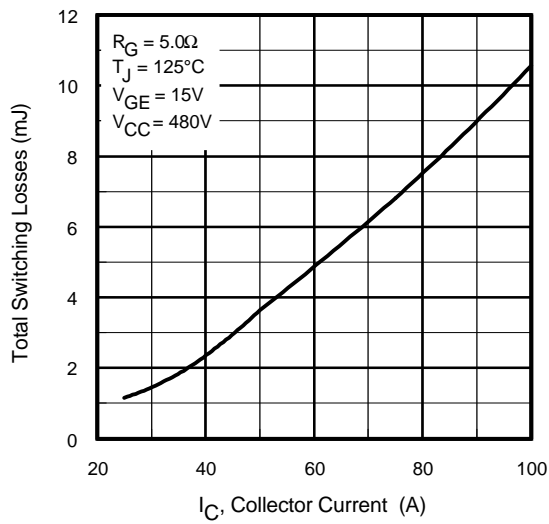


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

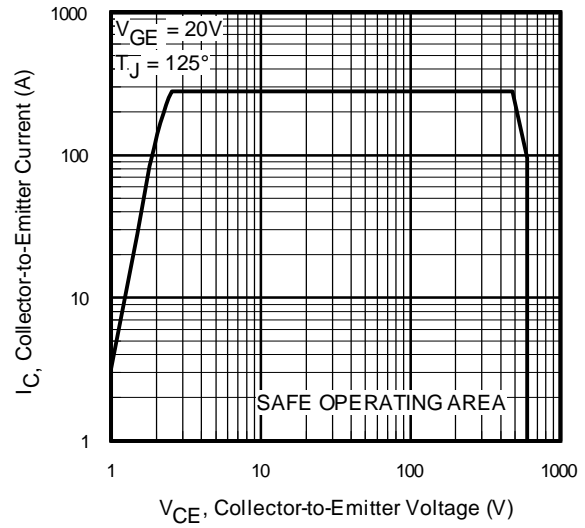


Fig. 12 - Turn-Off SOA

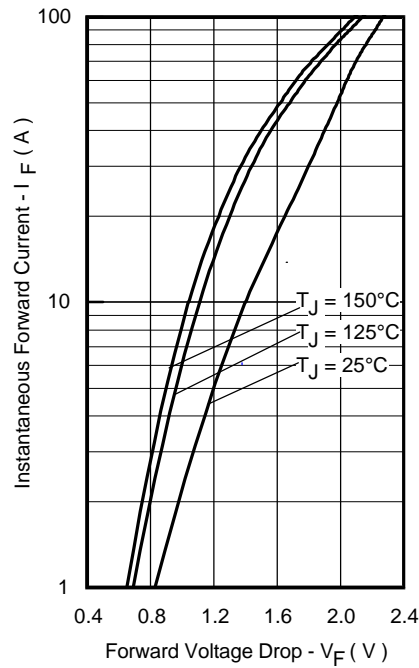


Fig. 13 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

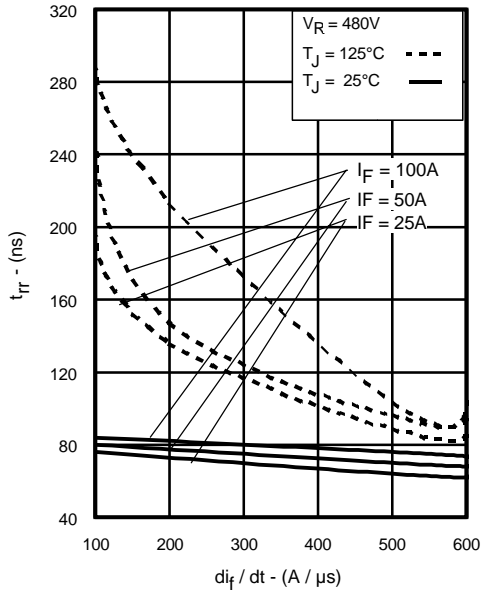


Fig. 14 - Typical Reverse Recovery vs. di_f/dt

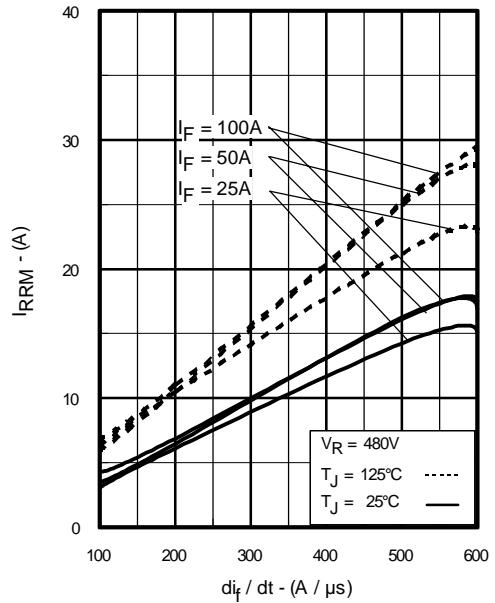


Fig. 15 - Typical Recovery Current vs. di_f/dt

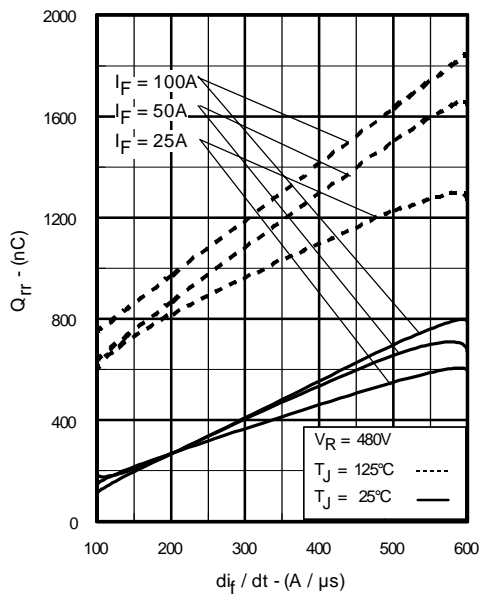


Fig. 16 - Typical Stored Charge vs. di_f/dt

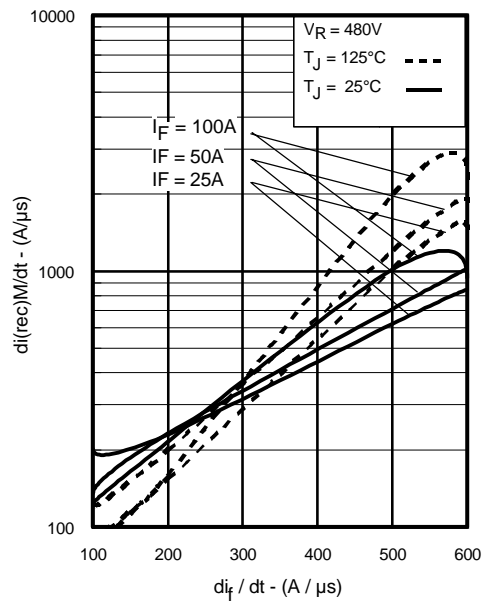
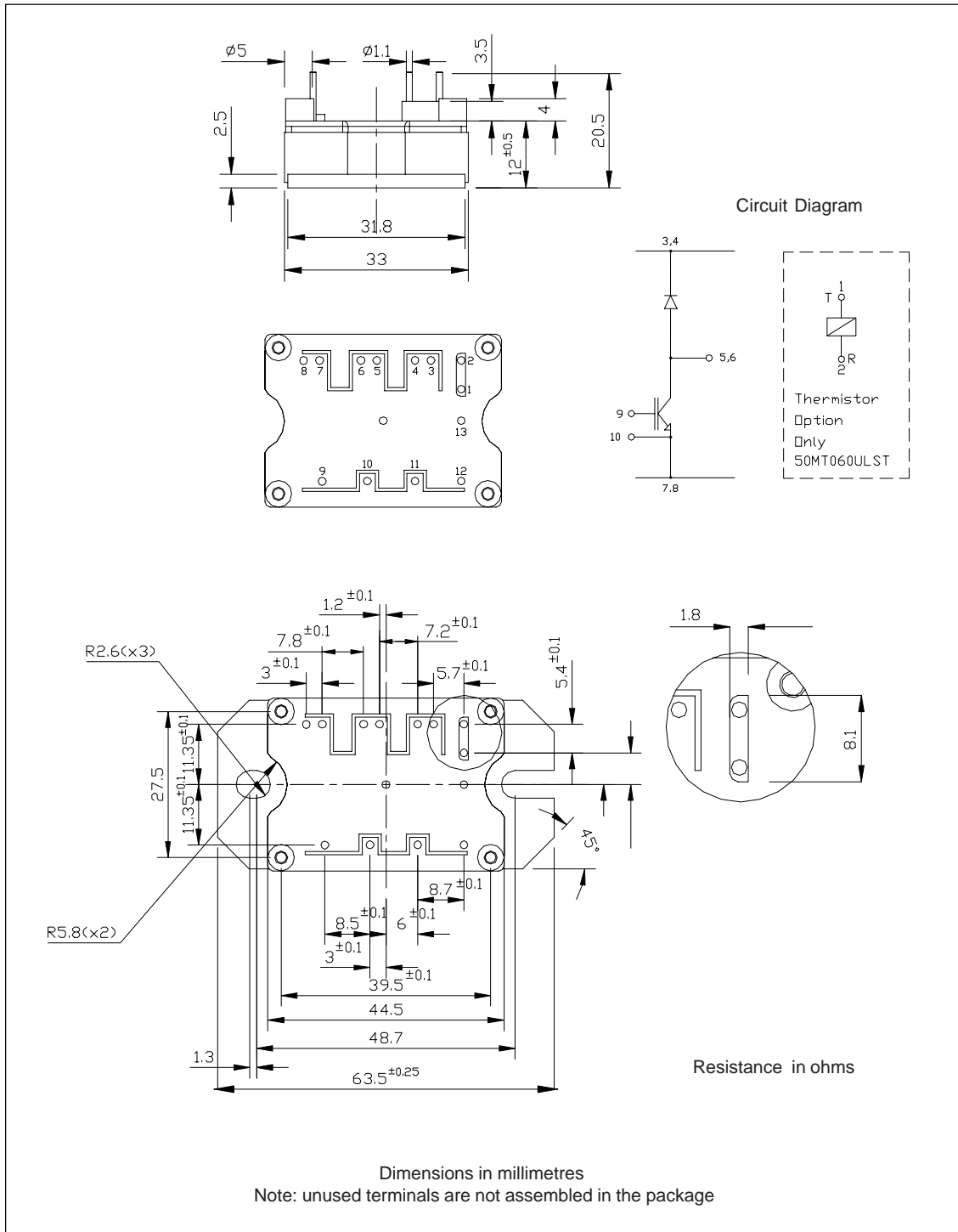


Fig. 17 - Typical $di_{(rec)M}/dt$ vs. di_f/dt

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

Empty = no special option
T = Thermistor

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.